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Canadian Aviation
Safety Board

Rapport d'un fait aéronautique civil

Civil Aviation Occurrence Report

Canada

The Canadian Aviation Safety Board investigated this occurrence for the purpose of advancing aviation safety. It is not the object of the Board to determine or apportion any blame or liability.

AVIATION OCCURRENCE REPORT

PIPER PA-32R-300 LANCE C-GPJP
PRICE'S CORNERS, ONTARIO
02 FEBRUARY 1989

REPORT NUMBER 89Ø0058

SYNOPSIS

After reversing course on a night VFR cross-country flight and while flying beneath low cloud in freezing precipitation, the aircraft struck a steel hydroelectric transmission tower and crashed in an open field. All five occupants sustained fatal injuries.

The Canadian Aviation Safety Board determined that the pilot attempted a night VFR flight in unsuitable weather conditions.

21 March 1990

Ce rapport est également disponible en français.

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1.0 FACTUAL INFORMATION

1.1 History of the Flight

On the afternoon of 02 February 1989, the pilot of the Piper PA-32R-300 Lance, C-GPJP, contacted hangar personnel at the Waterloo-Guelph Regional Airport, where he stored the aircraft, and instructed them to have the aircraft out for a 1700 eastern standard time (EST)* departure. Just prior to 1700 EST, the pilot arrived at the hangar and had the aircraft fuelled to capacity with 100/130 octane fuel. He and four passengers then boarded the aircraft. The purpose of the pleasure flight was to transport three of the passengers to North Bay for an ice fishing trip. The pilot intended to return to Waterloo with one of the passengers the same evening. No flight plan or flight notification was filed for the flight. The pilot's wife was aware that he was flying to North Bay and returning to Waterloo the same night.

At 1734 EST, the pilot contacted Waterloo Ground Control requesting taxi clearance for a visual flight rules (VFR)** flight to North Bay and was given taxi instructions for departure from runway 07. An altimeter setting of three zero one four (30.14) inches of mercury was given to and acknowledged by the pilot. Six minutes later, at 1740 EST, the pilot requested and was given take-off clearance, with a left turn out. The aircraft departed the airport at 1740 EST.

After take-off, the aircraft tracked outbound toward its destination, and, at 1744 EST, the pilot advised the Waterloo Tower that he was clear of the control zone to the north. At no time during this communication, did the pilot indicate at what altitude he intended to fly. There was no further communication with the flight.

The flight continued on the 020-degree track to a point 29 nautical miles northeast of the Waterloo Airport where a left 180-degree turn was carried out. The flight had just intercepted the reciprocal track toward

* All times are EST (Coordinated Universal Time (UTC) minus five hours) unless otherwise stated.

** See Glossary for all abbreviations and acronyms.

Waterloo when, at 1800 EST, the aircraft struck a steel hydroelectric transmission tower, 20 nautical miles northeast of the Waterloo Airport and crashed in an open field. All five occupants were fatally injured.

Several witnesses in the immediate area and to the north of the accident site reported hearing and seeing a low flying aircraft, fitting the description of the accident aircraft, flying in a southwest direction minutes before the aircraft struck the tower. Some reported hearing the aircraft flying low, heading northeast, and then a few minutes later, hearing it return, flying in the opposite direction still at low altitude. A local resident located the wreckage about 40 minutes after hearing the aircraft fly over.

An air traffic control radar, located at Caledon 13 miles from the accident site, tracked the flight from take-off to collision with the hydro tower. The data were recovered and analysed to provide the flight path of the aircraft.

The accident occurred during the hours of darkness, at lat 43°48'N, long 80°15'W***, at an elevation of 1,575 feet above sea level.

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	1	4	-	5
Serious	-	-	-	-
Minor/None	-	-	-	-
Total	1	4	-	5

1.3 Damage to Aircraft

The aircraft was destroyed.

1.4 Other Damage

The arm supporting the skywire on the east side of the hydro transmission tower was damaged and had to be replaced. The skywire on the west side of the tower was scuffed and stretched, requiring replacement of attachment fittings on several towers.

*** Units are consistent with official manuals, documents, reports, and instructions used by or issued to the crew.

1.5 Personnel Information

	Pilot-In-Command
Age	41
Pilot Licence	Private
Medical Expiry Date	01 January 1990
Total Flying Time	441 hr
Total on Type	24 hr
Total Last 90 Days	7 hr
Total on Type Last 90 Days	7 hr
Hours on Duty Prior to Occurrence	N\A
Hours off Duty Prior to Work Period	N\A

1.5.1 Background of the Pilot

In May 1974, the pilot was issued his private pilot licence which authorized him to fly single-engined aircraft, 4,000 pounds and under, day VFR. He had had a medical examination on 28 November 1988 to validate his pilot licence. His pilot licence was not endorsed for night flying, nor had he applied for a night endorsement. The pilot had not written any examinations for the purpose of acquiring an instrument rating.

From March 1981 until the time of the accident, the pilot had accumulated a total of 26.7 hours instrument flight instruction, 4.7 hours dual night flight instruction, and 20.1 hours solo night flying. The most recent record of night flying was 21 January 1989. Journey Log Book entries indicate that the pilot had carried passengers on night flights previous to the accident flight.

The Piper PA-32R-300 Lance aircraft was purchased by the pilot in August 1988. Prior to acquiring the Lance model, he owned a Piper PA-32-300 Cherokee Six, a similar type fixed landing gear aircraft, in which he had accumulated approximately 87 hours flying time.

The pilot occupied the left front seat and was at the controls at the time of the accident.

1.6 Aircraft Information

Manufacturer	Piper Aircraft Corporation
Type	PA-32R-300 Lance
Year of Manufacture	1977
Serial Number	32R-7780026
Certificate of Airworthiness	21 December 1987
Total Airframe Time	1,008 hr
Engine Type	Lycoming IO-540-K1G5D
Propeller Type	Hartzell HC-C2YK-1BF Constant speed
Maximum Allowable Take-off Weight	3600 lb
Recommended Fuel Type	100/130

The aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The weight and centre of gravity were within the prescribed limits at the time of the accident.

The aircraft was not equipped with anti-ice or de-ice equipment, except for a heated pitot/static source.

1.7 Meteorological Information

On 02 February 1989, at 1300 EST, an area of low pressure was situated south of Jamestown, New York with a warm front east-southeast to Wilkes-Barre, Pennsylvania and a cold front southwest to Cincinnati, Ohio. By 1900 EST, the centre of the low had moved east to Philipsburg, Pennsylvania with the warm front southeast and the cold front southwest through Cincinnati. Extensive cloud based at 2,000 to 3,000 feet above ground level (agl) was present over southwestern Ontario, and light precipitation in the form of snow, snow grains, ice pellets, and freezing drizzle fell at London, Waterloo, Hamilton, and Toronto throughout the afternoon and early evening.

The Area Forecast issued at 1230 EST, 02 February 1989, valid for a 12-hour period for southwestern Ontario, forecast skies to be generally overcast with clouds based at 3,000 feet above sea level (asl) and visibility three to five miles in light snow with patchy light freezing drizzle and local areas with cloud ceilings at 700 to 1,000 feet agl. The forecast also indicated moderate clear icing in freezing drizzle below 4,000 feet asl with the freezing level at the surface and an above freezing level between 3,000 and 7,000 feet asl.

The Aerodrome Forecast issued at 1130 EST, 02 February 1989, valid from 1200 to 1600 EST for the Waterloo-Guelph Regional Airport, was as follows: broken cloud at 2,500 feet agl, overcast cloud at 7,000 feet agl, occasional overcast cloud at 1,200 feet agl, with light snow and a risk of light freezing drizzle. The Aerodrome Forecast for North Bay forecast light snow to commence falling after 1900 EST.

The last weather observation for Waterloo-Guelph Airport taken at 1600 EST, 02 February 1989, reported broken cloud at 2,500 feet agl, 7,000 feet agl overcast, visibility 15 miles, with the temperature -09 degrees Celsius and the dew point -13 degrees Celsius. The wind was from 070 degrees true at seven knots. An automatic recording device in the Waterloo-Guelph Control Tower recorded cloud based at better than 2,500 feet agl when the pilot took off, and there were no recorded reductions in the level of the cloud base for more than one hour after the take-off. The 1800 EST weather observation for Toronto/Lester B. Pearson Airport reported overcast cloud at 3,200 feet agl and a visibility of five miles in light snow.

At the time of the accident, it was dark with low overcast skies and freezing precipitation. A pilot of a Cessna 172 flying in the area approximately one hour before the accident reported cloud bases at 2,800 feet asl and freezing precipitation south of the accident site. He stated that, at that time, clear ice formed on the windscreen of his aircraft and that the whole windscreen frosted over. He also reported that ceilings and visibilities appeared lower to the north.

Actual and Forecast weather reports are available to pilots by visiting or telephoning the Waterloo-Guelph Regional weather office at the airport between the hours of 0600 and 1600 EST and at other times from the London Flight Service Station by toll-free telephone line.

It is not known if the pilot checked the weather, but a thorough review uncovered no record or other evidence that he had received a weather briefing for the intended flight.

1.8 Aids to Navigation

The Waterloo-Guelph non-directional beacon (NDB), frequency 251 kilohertz (kHz), located four nautical miles north of the airport, and the Ash very high frequency omnidirectional range (VOR), frequency 115.0 megahertz (MHz), located 17 miles south of the airport, serve as approach facilities to the Waterloo Airport.

The North Bay Airport is served by NDBs and a VOR, frequency 115.4 MHz. The Midland VOR, frequency 112.8 MHz, located en route between Waterloo and North Bay, serves Victor Airway 332 and joins with the North Bay VOR located on the North Bay Airport. All the above-mentioned VORs are co-located with distance measuring equipment (DME).

All of the navigational aids in the area were reported to be serviceable during the period of the flight.

The aircraft was equipped with ARNAV 30A Loran C navigation equipment.

1.9 Communications

Two-way very high frequency (VHF) radio communication between the aircraft and the Waterloo Control Tower was carried out without difficulty.

1.10 Aerodrome Information

The Waterloo-Guelph Regional Airport is a publicly licensed airport with lighting for night operation of aircraft. The airport reference elevation is 1,040 feet asl. The airport control tower was in operation from before the time of take-off until after the time of the accident. The airport control zone extends for a five nautical mile radius of the airport centre with vertical limits below 4,000 feet asl.

1.11 Flight Recorders

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder, nor was either required by regulation.

1.12 Wreckage and Impact Information

The hydro transmission tower is a grey steel structure, the top of which is 192 feet agl, and forms part of one line of towers on a ridge that is about 1,575 feet asl. There are two hydro transmission lines and other single towers on the ridge in the accident area. The hydro towers and the lines are unlit and unmarked; hydro regulations do not require lighting or marking unless the towers exceed 500 feet in height.

Arms extending from both sides of the tower support the hydroelectric lines. Two arms at the top of the tower extend 35 feet on either side of the tower and support skywires at the end of each arm. The skywires do not have electric current travelling through them. The hydro line, which is oriented in a northwest/southeast direction, is depicted on the air navigation charts.

The right wing of the aircraft struck the bottom of the arm supporting the skywire on the east side of the tower. Initial impact occurred while the aircraft was on a southwest heading, tearing off the outboard section of the right wing. The left wing struck the skywire on the west side of the tower, shearing off the outboard wing section. The aircraft continued on a southwest heading and struck the ground in an inverted position, 1,034 feet beyond the tower. The inboard section of the left wing separated from the aircraft and fell 586 feet beyond the tower. Outboard sections of the right wing were found lodged in the tower and on the ground at the base of the tower.

The destruction of the cockpit on impact rendered the position of switches and levers at the time of impact meaningless, and, as a result, except for the cabin ventilation switch which was selected on high, it could not be determined what position the cabin heater was selected to, nor whether the pilot had selected the pitot-static heat on.

Approximately 12 hours after the accident, a thin layer of ice comprising a mixture of clear and rime was found along the leading edge on sections of the left wing. Traces of ice were found along the leading edge of the horizontal stabilator as well.

The altimeter was found with the subscale set to 30.14 inches, the departure airport setting.

Navigation and communication equipment recovered from the wreckage revealed the following information:

VHF NAV #1 - Selected on and tuned to the Midland VOR
VHF NAV #2 - Selected on and tuned to the Ash VOR

Omni Bearing Selector (OBS) for NAV #1 - Set on the 020-degree radial

OBS for NAV #2 - Set on the 024-degree radial

DME - Selected on and set to NAV #1

Automatic Direction Finding (ADF) - Selected to ADF Mode and tuned to Waterloo-Guelph

LORAN C - Selected on

VHF COMM #1 - Selected on and tuned to Waterloo-Guelph Tower

VHF COMM #2 - Selected on and tuned to Waterloo-Guelph Ground

Communication Selector - Selected to COMM #2

Transponder - Selected on and set to Code 1200

1.13 Medical Information

There was no evidence that incapacitation, physiological, or psychological factors affected the pilot's performance.

1.13.1 Pathological Findings

Post-mortem examination of the pilot did not reveal any evidence of disease that would have contributed to the cause of the accident.

1.13.2 Toxicological Findings

Toxicological examination did not reveal any substances that would have affected the performance of the pilot. Toxicological test results were positive for the presence of ethanol in three of the passengers.

1.14 Fire

There was no evidence of fire either before or after the occurrence.

1.15 Survival Aspects

The impact was non-survivable due to the magnitude of the deceleration forces and the destruction of the aircraft fuselage.

The aircraft was equipped with a DEFT-1 emergency locator transmitter (ELT). The ELT was recovered undamaged with the function switch in the ARMED position; but there were no reports of any agencies, including ground search parties with hand-held radios in the vicinity of the crash site, receiving a signal from the ELT. The ELT was removed from the wreckage and switched off; it was then sent to the Canadian Aviation Safety Board (CASB) Engineering Laboratory for

testing. Switching off the ELT resets the G switch; consequently, it could not be determined if the G switch had activated on impact. The ELT antenna was not damaged in the crash.

The ELT was examined and tested by the CASB Engineering Laboratory. The G switch was functionally serviceable, and the ELT met the required electronic specifications; however, when the ELT was transmitting, the ELT signal was not received by any of the SARSAT tracking stations nor by Ottawa Tower. The sweep rate was reduced from 2.9 to 2.4 Hz, within the specified sweep rate of 2 to 4 Hz, and the ELT transmission was received by SARSAT and a ground station at Ottawa. It was not determined why the ELT would not activate the SARSAT and ground receiver when operating at all sweep rates within the specifications. Four out of 50 other DEFT ELTs tested, all of which met specifications, required the same type of modification in order to activate SARSAT. Further testing of this type of ELT has been proposed.

The aircraft was never reported to authorities as missing or overdue. A local resident who heard the aircraft and suspected that it had struck the power line searched along the line on foot and, after approximately 30 to 40 minutes, located a section of wing. With the assistance of the Ontario Provincial Police, the main wreckage was located approximately one hour later.

1.16 Tests and Research

All the aircraft components, with the exception of a section of one propeller blade tip, were recovered within the confines of the accident site. The section of the propeller blade was not recovered. Following an on-site examination, the wreckage was transported to a compound and reconstructed to determine mode and sequence of failure. All airframe and airframe component failures were consistent with tower and ground impact, with no evidence of any pre-impact malfunction of the aircraft or its flight controls.

1.16.1 Aircraft Engine and Propeller

The aircraft engine was removed from the accident site and examined. The engine rotated freely with evidence of adequate lubrication. There was compression on all cylinders, and all spark plug electrodes were clean and serviceable. There was no evidence of any malfunction of the engine to suggest that it was not capable of producing adequate power to sustain flight prior to the aircraft striking the tower.

Both propeller blades were extensively damaged. An examination of the fracture surface on the blade that had a section of the blade tip missing did not show any evidence of fatigue or pre-impact failure.

1.16.2 Fuel Analysis

The contents of both aircraft fuel tanks were lost during the break-up of the aircraft wings on impact with the tower. The engine fuel metering unit and associated fuel components were torn off on ground impact, leaving little or no fuel trapped in the aircraft fuel system. A fuel sample was taken from the fuel truck used to refuel the aircraft just prior to departure from the Waterloo-Guelph Airport and sent for analysis to the Fuels and Lubricants Division of the National Research Council. There were no contaminants found in the fuel sample that would have affected the operation of the aircraft engine.

1.17 Additional Information

1.17.1 Private Pilot Privileges

According to Air Navigation Order Series IV No. 2, a private pilot may operate an aircraft as pilot-in-command at night, if he has a night endorsement on his licence and has completed " not less than five take-offs and landings by night in the same category and class of aircraft during the six months immediately preceding the flight, and the aircraft is of a category, class, and type endorsed on his licence."

The Personnel Licensing Hand Book, Volume 1, states that the following are required to obtain a night rating endorsement:

"(a) An applicant for a night rating shall acquire dual night and instrument flight time for this rating from the holder of a flight instructor rating and, except as provided for below, he shall have acquired in the same category of aircraft, not less than 20 hours of pilot flight time which shall include not less than

(i) 10 hours of night flight time including not less than

(A) 5 hours dual flight time, including 2 hours of cross-country flight time,
(B) 5 hours solo flight time, including 10 take-off circuits and landings, and

(ii) 10 hours dual instrument time of which not more than 5 hours may be instrument ground time. Instrument time shall be in addition to the 10 hours night flight time in sub-paragraph (a)(i) and where the instrument time includes instrument ground time, the 10 hours night flight time shall be increased by an amount equivalent to the instrument ground time."

2.0 ANALYSIS

2.1 Introduction

While on a night VFR flight from Waterloo-Guelph Airport to North Bay Airport, the aircraft struck a steel hydroelectric transmission tower. At the time, the pilot was flying at less than 200 feet above ground level. The aircraft was destroyed, and the five occupants were fatally injured.

The analysis focuses on the weather conditions, the aircraft and its serviceability, and the pilot's flying experience.

2.2 The Flight

The aircraft departed from Waterloo-Guelph during daylight hours in VFR conditions; however, the flight could not have been completed before dark as only approximately 15 minutes of official daylight were left in the day. Because of the thick overcast sky condition, darkness would have occurred before official night (30 minutes after sunset).

The course plotted from the stored radar data indicated the route of flight chosen by the pilot was direct to North Bay, suggesting that he was using the Loran C equipment on board the aircraft. The equipment has the capability of displaying the track for the pilot to fly directly between points and, once airborne, supplies heading information for the pilot to maintain the desired track.

Several witnesses reported that a low flying aircraft, fitting the description of the accident aircraft, was flying in a southwest direction minutes before the accident aircraft struck the tower. Some witnesses reported hearing the aircraft flying low, heading northeast, and then a few minutes later, hearing it return, flying in the opposite direction still at low altitude.

It was concluded from the witness reports and the radar plot that the pilot had reversed course and, in all likelihood, was returning to the Waterloo-Guelph Airport because he had encountered low ceilings and freezing precipitation along his route of flight. To remain below the low cloud ceiling, the pilot would have had to fly at low altitude. This would account for the several reports and sightings of the low flying aircraft a few miles northeast of where the accident aircraft struck the steel tower.

There was evidence of airframe icing on the leading edge of the left wing and stabilator of the aircraft. The amount of ice on the wing was not considered sufficient to seriously affect the flight characteristics of the aircraft. However, with only the aircraft normal windscreen defroster system, it is likely that there would have been sufficient ice build-up on the windscreen to seriously restrict the pilot's forward visibility while attempting to fly by visual reference. The pilot of a Cessna 172 flying in the area approximately one hour before the accident reported that clear ice formed on the windscreen of his aircraft and that the windscreen frosted over completely.

The combination of darkness and the restricted forward visibility because of the ice build-up on the windscreen likely resulted in the pilot's not seeing the tower in sufficient time to avoid the collision, or possibly not observing it at all. Following the collision with the tower, the aircraft was no longer controllable.

2.3 Weather

Low ceilings, freezing precipitation, and poor visibility due to the darkness prevailed in the accident area prior to and at the time of the accident. These conclusions were supported by numerous eyewitness reports of the aircraft flying just above tree and building top height and just below the overcast cloud some distance before the collision with the tower. The thin layer of ice on the leading edge of a section of the left wing was typical of ice build-up during flight through freezing precipitation. Ceilings and visibilities reported at the Waterloo Airport, both at the time of departure and at the time of the accident, were adequate for VFR flight.

All weather information sources had forecast well in advance the risk and possibility of low ceilings and freezing precipitation throughout the southwestern Ontario region, for the time period the pilot planned the trip. The weather aftercast and the hourly weather observations supported the accuracy of the weather forecast.

It is not known if the pilot checked the weather, but there was no evidence that he had received a formal weather briefing from any of the numerous agencies in the southwestern Ontario region or from the North Bay facilities.

2.4 Aircraft

The aircraft was not equipped with any airframe or windscreen anti-ice or de-ice equipment, nor was such equipment required by regulation. With the surface temperature in the -9 to -10 degree Celsius range, it is unlikely the normal windscreen defrost system would have supplied sufficient heat to remove an appreciable amount of ice from the windscreen during cruise flight even if the pilot had selected all the heat to defrost. Because of the destruction of the cockpit on impact, except for the cabin ventilation switch, which was selected on high, it could not be determined what position the cabin heater was selected to, nor whether the pilot had selected the pitot-static heat on.

There was no evidence of any pre-impact failure of the aircraft, aircraft systems or power plant that would have contributed to the cause of the accident. There was adequate fuel on board to complete the flight. Examination of the aircraft engine revealed it was well lubricated and was capable of normal operation at the time of the accident.

2.5 Pilot Experience

The pilot was issued his private pilot licence in June 1974. His licence was valid at the time of the accident but was not endorsed for night flying. He had received sufficient solo night flying experience and sufficient instrument flying training but required .3 additional hours of dual night flying training in order to apply to Transport Canada for the night endorsement on his licence. In February and March of 1984, he underwent several hours instrument training in the use of VOR and ADF navigation aids for approaches and cross-country navigation. In view of this training and the equipment on board the aircraft, it is most likely that the pilot was navigating primarily by Loran C using VOR and ADF for backup. Navigating in this manner, it is unlikely he would have been referring to an aeronautical chart depicting the location of the hydro line. As a consequence, he may have been unaware that he was approaching the hydro line.

The pilot was not instrument rated and would likely have been intent on maintaining visual contact with the ground in order to return to more favourable weather conditions to the south, from where he had just flown. However, in order to remain below the low overcast cloud, he was forced to fly at too low an altitude to safely clear the top of the steel tower and, as a result, struck the tower approximately seven feet below the top.

Entries in the pilot's log book indicated he was familiar with the Waterloo to North Bay route, having flown the trip on several previous occasions.

2.6 Flight Plans/Flight Notifications

A flight plan or flight notification was not filed, and the pilot's wife was not aware of the arrival or departure times. Therefore, no one knew the flight had not arrived at North Bay nor returned to Waterloo-Guelph. Had the local resident not heard the aircraft and on his own initiative gone out to search for the aircraft, it is unknown when it would have been discovered. Filing a flight plan for a flight of this nature assures notification of the proper Search and Rescue authorities when the aircraft fails to arrive at its destination and, in the event of a survivable accident, provides timely rescue of survivors.

2.7 ELT

Although the ELT function switch was in the ARMED position, the SARSAT did not receive an ELT distress signal from the unit. Examination of the ELT showed that the G switch was serviceable and that it met the required electronic specifications. Small sweep rate changes within specifications allowed the transmissions to be received; however, the reason for this anomaly was not determined.

3.0 CONCLUSIONS

3.1 Findings

1. The pilot encountered low cloud and freezing precipitation during a night VFR cross-country flight.

2. The pilot reversed course and, while flying beneath the cloud at less than 200 feet agl in freezing precipitation, the aircraft struck a steel tower.

3. The pilot's forward visibility was likely reduced by darkness and ice build-up on the aircraft windscreen.

4. The reduced forward visibility would have prevented the pilot from seeing the tower in time to avoid the collision.

5. Low cloud and areas of freezing precipitation were forecast and were present along the pilot's route of flight.

6. No evidence could be found that the pilot had received a weather briefing for the flight.

7. No flight plan was filed for the flight, and authorities did not know the aircraft was overdue.

8. The ELT did not activate the SARSAT.

9. There was no evidence of any pre-impact failure or system malfunction.

10. The aircraft was certified, equipped and maintained in accordance with regulations and approved procedures.

11. The aircraft weight and centre of gravity were within the prescribed limits.

12. The pilot's licence was not endorsed for night flying.

3.2 Causes

The pilot attempted a night VFR flight in unsuitable weather conditions.

4.0 SAFETY ACTION

4.1 Action Taken

4.1.1 DEFT-1 Electronic Locator Transmitter (ELT)

Although the ELT met all specifications, its signal was not detected by sensors in the Search and Rescue Satellite (SARSAT), possibly due to an electronic anomaly in the ELT. A similar anomaly was discovered in four other DEFT-1 units, and the manufacturer has modified an electronic circuit on newly manufactured units and conducts a diagnostic test for the anomaly during annual inspections of units in service.

Because other overhaul facilities may not have been aware of the anomaly or its remedy, the CASB issued an Aviation Safety Advisory to Transport Canada suggesting that approved maintenance facilities be informed of the problem and that a suitable functional test be required on all DEFT-1 units. In addition, it was suggested that operators be encouraged to submit these units for inspection before the annual due date.

4.2 Safety Concerns

4.2.1 Pilot Decision-Making

This accident provides yet another tragic example of the consequences of operating an aircraft with inadequate pre-flight preparations.

The percentage of aircraft accidents attributable, wholly or in part, to pilot judgment is alarmingly high. The Federal Aviation Administration in the United States has estimated that, during the period between 1970 and 1974, 52 per cent of fatal and 35 per cent of non-fatal accidents involved pilot judgment errors.

In an effort to address the issue of pilot judgment, Transport Canada has embarked on an innovative training program to reduce the number of judgment-related aircraft accidents. The Pilot Decision Making (PDM) training now being introduced is designed to show pilots how to identify risk, stress, and hazardous lines of thought; the PDM program then offers ways of improving judgment and decision-making. It is anticipated that the benefits of this training will eventually be evident by a reduction of pilot-related cause factors in accident statistics.

The Canadian Aviation Safety Board fully supports this initiative and will be following the progress of its implementation and effectiveness with interest.

4.2.2 VFR Flight into Adverse Weather

The Canadian Aviation Safety Board has long been concerned with the large number of aviation occurrences in which flights into adverse weather conditions were initiated or continued while the aircraft was operating under visual flight rules (VFR).

This accident is typical of 352 such accidents which occurred between 1976 and 1985 as recorded in the CASB's Canadian Accident/Incident Database (CAIDS). The regularity with which these accidents have occurred and the continuing loss of life prompted the CASB to initiate a comprehensive and systematic examination of the issue of continued VFR flight into adverse weather conditions. Accidents involving VFR flight into adverse weather account for only 6 per cent of all reported accidents, but they account for 23 per cent of all fatal accidents, cause 26 per cent of all fatalities and result in 10 per cent of the serious injuries. The CASB's study is expected to include several recommendations in 1990 to reduce the frequency of this type of accident.

This latest accident highlights three areas of concern which appear all too frequently in those accidents reviewed by the CASB during the course of the study. These safety issues are as follows:

(a) Night VFR Weather Limits

A high number of fatal, weather-related VFR accidents occur at night; (i.e., 29 per cent of the weather-related accidents studied). Most of these occurred in uncontrolled airspace. Many of these involved inadvertent entry into instrument meteorological conditions (IMC) or impact with obstructions or rising terrain.

The weather limits prescribed by Transport Canada for night operations are identical to day VFR limits. The minimum flight visibility limit required for VFR flight while in uncontrolled airspace, such as in this accident, is one mile. This visibility criterion, under certain atmospheric and light conditions, is probably inadequate to allow a pilot the required time to see and avoid obstacles or avoid inadvertent entry into IMC. Higher weather limits, specifically formulated for night VFR operations, may be warranted.

(b) Pre-flight Weather Briefings

A number of weather-related accidents involve pilots who elected not to use available weather information services. The studied accident files show that 44 per cent of the aeroplane accident pilots and 72 per cent of the helicopter accident pilots did not receive pre-flight weather briefings. They commenced flight without information which ultimately may have averted the accident. Such information is vital in the pre-flight decision-making process.

Air Regulations require that, prior to commencing flight, pilots-in-command shall familiarize themselves with all available information appropriate for the intented flight (Air Regulation 505). Few pilots have a personal copy of the Air Regulations; however, all Canadian licensed pilots are provided with a copy of the Aeronautical Information Publication (AIP) by Transport Canada. The AIP states only that, prior to flight, a pilot should receive a pre-flight weather briefing (Chapter 3.1). Pilots may be misled by this permissive interpretation of the Air Regulations, and an amendment to the AIP may be required to more closely reflect the intent of Air Regulation 505.

The mere existence of a regulation would not in itself advance safe flying practices; rather, a major safety promotional campaign aimed at VFR pilots may be required with a view to changing the apparently all-too-frequent lack of concern which some pilots have with respect to obtaining the necessary pre-flight weather information.

(c) Filing of VFR Flight Plans

Approximately 20 per cent of the studied accident flights were commenced without having filed a flight plan, flight notification, or flight itinerary. In many cases, this resulted in a delay in alerting Search and Rescue (SAR) authorities of the mishap and, as a consequence, undue delay in effecting rescue and medical treatment of survivors.

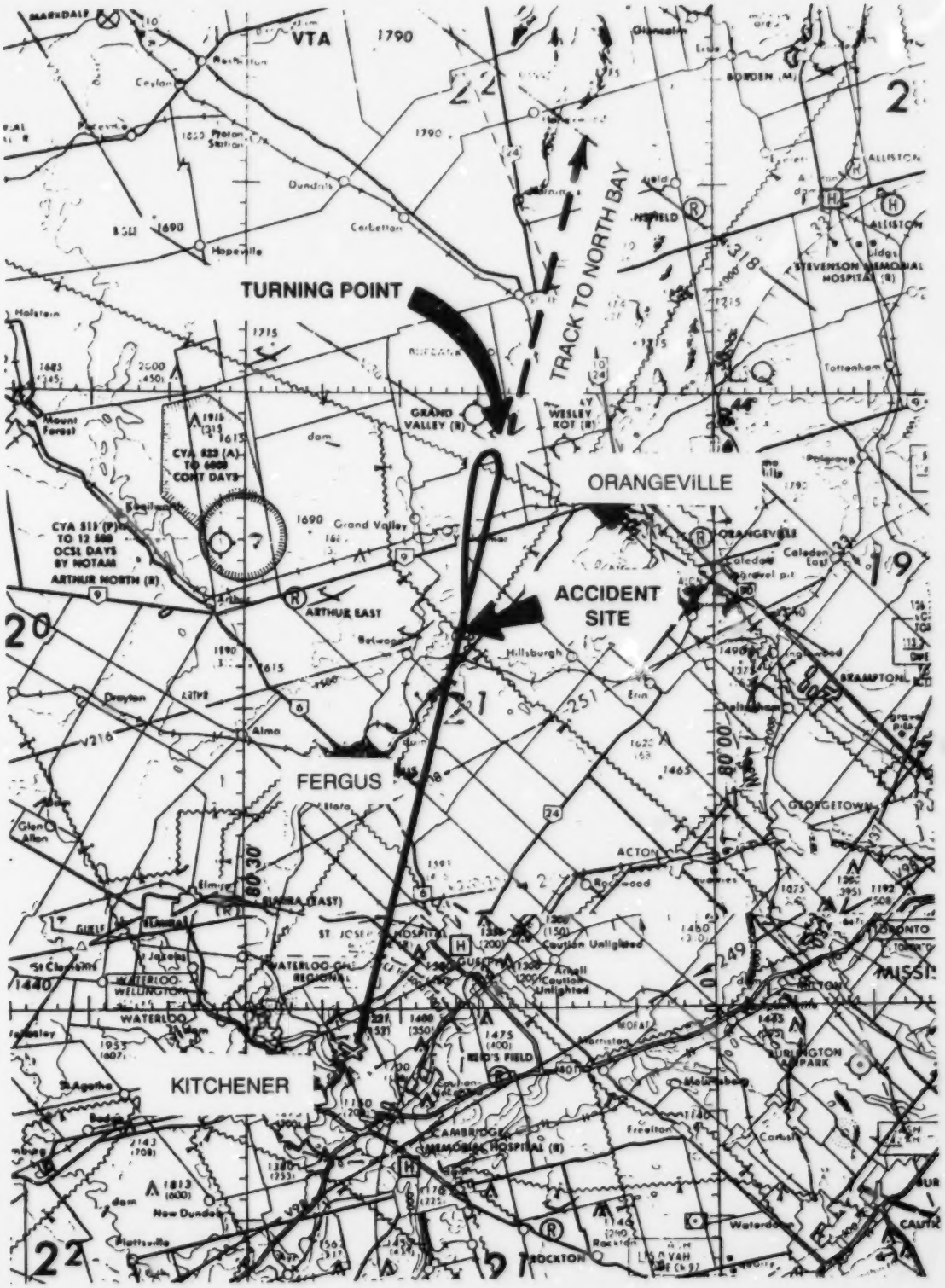
The Board is concerned that this high percentage of instances of flights being undertaken without flight plans, flight notifications, or flight itineraries may be another indication of the cavalier attitude on the part of some VFR pilots with respect to pre-flight preparations. More stringent procedures may be required.

By identifying and discussing these and other related safety deficiencies, the study's report will aim at concentrating the attention of the general aviation public, the aviation industry, the regulatory agencies, and other special interest groups on the contributing causes of weather-related VFR accidents. Through this awareness and a concentrated effort throughout the VFR community, it is the Board's belief that the loss life in this type of accident can be reduced.

This report and the safety action therein has been adopted by the Chairman, K.J. Thorneycroft, and Board Members:

N. Bobbitt
L. Filotas
W. MacEachern
D. Mussallem
A. Portelance
B. Pultz
R. Stevenson
F. Thurston

FLIGHT PATH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TRACK TO NORTH BAY
ORANGEVILLE
ACCIDENT SITE
FERGUS
KITCHENER
VTA
1790
Dundalk
Hopeville
Corbetton
Grand Valley
Arthur East
Arthur North (R)
Alma
Hillsburgh
Erin
Acton
Georgetown
Brampton
Waterloo
Cambridge
Preston
Hespeler
Baden
Stratford
Mount Forest
Holstein
Shelburne
Orangeville
Caledon East
Tottenham
Alliston
Stevenson Memorial Hospital (R)
Wesley Kot (R)
Grand Valley (R)
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CYA 813 (P) TO 12 500 OCSL DAYS BY NOTAM
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Elmira
Ayr
Paris
Brantford
Burlington
Toronto
Missi
Rockton
Waterdown
Carlisle
Freelton
Morriston
Moffat
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Glen Allen
St Clements
St Agatha
New Dundee
Plattsville
Drayton
Belwood
Inglewood
Bolton
Caledon
Gravel pit
Reid's Field
Waterloo Wellington
Waterloo Regional
St Joseph Hospital
Cambridge Memorial Hospital (R)
Guelph
Elmira (East)
Burlington Park
Caution Unlighted
Caution Lighted
Aerial
Obstn
Rec
Gravel
Quarry
Dam
Hospital
Golf
Airport
Rwy
Hdg
Rte
Trans Can Pipeline
Gas Pipeline
Oil Pipeline
Power Line
Railway
Trail
Road
Boundary
Prov Park
Conservation Area
Forest
Swamp
Marsh
Orchard
Vineyard
Cemetery
Church
Tower
Lighthouse
Windmill
Radio Mast
Radio Tower
Radio Beacon
Radio Range
Radio Station
Radio Compass Station
Radio Direction Finding Station
Radio Aid to Navigation
Radio Aid to Navigation (Range)
Radio Aid to Navigation (Beacon)
Radio Aid to Navigation (Station)
Radio Aid to Navigation (Compass Station)
Radio Aid to Navigation (Direction Finding Station)
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Radio Aid to Navigation (

APPENDIX B

LIST OF LABORATORY REPORTS

The following laboratory reports were completed:

LP 17/89 - Fuel Sample Analysis, and

LP 24/89 - ELT Analysis.

These reports are available on request from the Canadian Aviation Safety Board.

GLOSSARY

ADF	automatic direction finding
agl	above ground level
AIP	Aeronautical Information Publication
asl	above sea level
CAIDS	Canadian Accident/Incident Database
CASB	Canadian Aviation Safety Board
DME	distance measuring equipment
ELT	emergency locator transmitter
EST	eastern standard time
hr	hour(s)
IMC	instrument meteorological conditions
kHz	kilohertz
lat	latitude
lb	pound(s)
long	longitude
MHz	megahertz
NDB	non-directional beacon
OBS	Omni Bearing Selector
PDM	Pilot Decision Making
SAR	Search and Rescue
SARSAT	Search and Rescue Satellite
UTC	Coordinated Universal Time
VFR	visual flight rules
VHF	very high frequency
VOR	very high frequency omnidirectional range